920602-99756

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE THE APPLICATION OF)
)
Richard John Hawes)
)
SERIAL NO. 10/541,802) Customer No.: 23644
)
FILED: July 8, 2005)
)
FOR: Improved Pick and Place Gripper)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on August 30, 2005.
Name of person signing Minnie Wilson
Signature Minnie Wilson

CLAIM FOR PRIORITY

Honorable Director of Patents and Trademarks
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Under the International Convention, for the purposes of priority, applicant claims the benefit of UK Patent Application Numbers GB 0325068.5 filed October 28, 2003, GB 0417665.7 filed August 9, 2004 and GB 0415202.1 filed July 7, 2004.

Certified copies of said applications are submitted herewith.

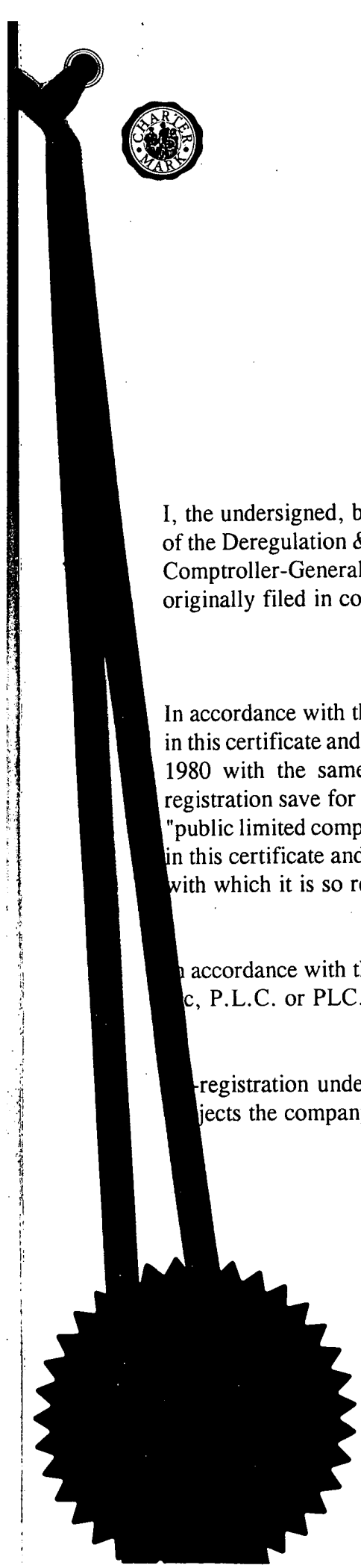
August 30, 2005

Respectfully submitted,

William M. Lee

William M. Lee, Jr.
Registration No. 26,935
Barnes & Thornburg
P.O. Box 2786
Chicago, Illinois 60690-2786
(312) 214-4800
(312) 759-5646 (fax)

CHDS01 WLEE 292025v1



The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

CERTIFIED COPY OF PRIORITY DOCUMENT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 4 July 2005

C1192/A

Title: Improved pick and place gripper

Field of invention

This invention concerns gripping devices (tooling) by which articles, especially but not exclusively portions of foodstuff, can be picked up from one place (typically a conveyor belt) moved and located at another place (typically onto another conveyor or into a container such as a tray on another conveyor).

Background

In the food processing and packaging industry it is known to cut large pieces of foodstuff such as meat, into smaller, usually similarly sized, portions and then to pack the cut portions individually or more commonly in groups of two, three or more, for display (usually in chilled or frozen display cabinets) for selection by the public for purchase.

Thus pork and lamb are cut into chops, beef into steaks and bacon into thin slices. The cutting from the bulk product is often achieved using a rotating blade and the portions (i.e. chops or steaks) are allowed to fall one after another onto a moving conveyor belt.

An escapement mechanism may be provided so that the portions are separated along the length of the conveyor, and in general the portions will tend to fall in a similar way so that for example in the case of port chops the edge of each chop which is covered by a layer of fat may for example always be the leading (or trailing) edge of each chop in the line – depending on whether the bulk pork from which they are cut is fat side up or fat side down.

However there is no guarantee that the portions will be so aligned on the conveyor.

It is considered desirable for the portions (e.g. chops) which are to be presented in a so-called pre-pack, to all be aligned in a similar manner and either shingled (so that except for the topmost portion, those below are partly obscured by those above), or the portions are attractively arranged side by side on a flat tray, so that the size and quality of all of the portions making up the pack can be seen.

Hitherto the picking up and placing of portions into trays or other containers, has been at least in part performed manually. While this has meant that product orientation has not been called for on the conveyor, the process is labour intensive, and production limited to the speed at which the operators can pick and place the portions. The work is also tedious.

It is an object of the present invention to automate the above process.

It is another object to provide apparatus which can be employed in use to pick and place similar articles (which may be similar items of food but could be any similarly sized articles such as small manufactured items), which are to be packed for storage, and display for selling.

Recent proposals

Improved gripper tools are described in our previously filed UK Patent Application No. 0325068.5. Experience has shown that, where they can be used, spikes such as 82 in Figs 1 and 2 of our earlier Application are a very reliable way of holding the product stationary as the blades 54, 56 are moved inwardly to form a support platform for the product, and outwardly, when the product is to be deposited at its new location. However, there are two situations where spikes are not desirable and the sprung fingers 88 of our earlier Application are not entirely satisfactory.

In particular product may comprise a collection of two or more separate or only tenuously attached pieces. Here the outward movement of the blades has been found to drag the

product pieces sideways and break them apart due to frictional contact between pieces and blades.

In other situations it may not be possible or desirable to pierce the product or even indent the upper surface (even if very short pins were to be used), and the sprung fingers 88 have not always provided sufficient frictional resistance to movement to prevent lateral dragging or separation of the pieces.

It is therefore an object of the present invention to provide an improved gripper tool which includes spikes or sprung fingers but which is adapted to reduce the risk of product separation or lateral movement due to sideways withdrawal of the blades.

It is also another object of the present invention to provide an alternative improved gripper tool which is adapted to restrain product laterally to prevent product separation or lateral movement due to sideways withdrawal of the blades, but which does not entail the use of spikes (and therefore will not penetrate the upper surface of the product) but which will still enable the product to be rotated by the tool (if required).

Summary of the invention

According to one aspect of the present invention in gripper tools such as described in our earlier Application a support member is positioned above each of the blades, and drive means is provided for moving the support members and the blades which in use operates to move the support members and the blades until product is gripped between the support members and thereafter to move the blades to their full extent below the product, the drive means maintaining the support members in the product gripping position as the blades are subsequently withdrawn from below the product to prevent frictional drag on the underside of the latter from separating or moving the product, and only operating to disengage the support members from the product after the blades have moved from below the product, thereby to allow the product to drop onto, or remain on, a support surface as the tool is raised.

The drive means for the blades and support members are typically pneumatic cylinders which may be double acting, or single acting in combination with return springs.

In order to only lightly grip the product between the support members a drive for these may include a lost motion connection in combination with a low spring rate compression spring which is compressed to the extent of the overrun and provides the lateral gripping force on the product and also ensures that the lost motion is accommodated as the drive retracts.

A preferred arrangement comprises a first double acting pneumatic cylinder adapted to move the blades and support members as a single unit and a second double acting pneumatic cylinder adapted to move the blades relative to the support members.

Other motive power drives may be employed such as electric motors and/or electromagnetic solenoids and/or hydraulic drives.

Each support member may be in sliding contact with the upper surface of the blade with which it is associated, so that the relative movement during closure on product and/or during opening to release the product, acts in a self-cleaning manner, and the support member can be thought of as scraping the upper surface of the blade, and to that end can be described as a scraper.

In so far as it is not necessary to fully retract both blades and support members in order to release product, in use the drive means may be operated to retract the blades so as to align with the inner faces of the support members and then for the drive means to retract both blades and support members in synchronism, by a distance just sufficient to release the product, so that its position relative to the support surface remains substantially undisturbed from that determined by the position to which the tool has been moved. In this way as the tool is raised vertically clear of the product the support members continue to locate the product until the tool has been raised clear thereof, after which the drive means may be operated to fully retract the support members and the blades.

The step of fully retracting the support members and blades may be effected in transit as the tool returns to pick up more product and if the product.

According to another aspect of the present invention the spikes or sprung fingers of the tools disclosed in our earlier Application can be replaced by an array of spaced apart displaceable elongate rod-like fingers which are mounted so as to extend generally normal to the plane containing the two blades, so that in use as the tool is lowered over product with the blades retracted the lower ends of some of the fingers will engage the upper surface of the product and as a consequence will be pushed upwardly as the tool continues to move downwardly over and around the product, but other of the fingers which do not register with the product will not be pushed upwardly but will remain extended and will surround the product and in use will provide lateral support therefor as the blades subsequently move relative to the underside of the product both inwardly and outwardly.

The fingers may have pointed, but more preferably blunt, lower ends, and may be resiliently biased in a direction towards the blades or may simply be a sliding fit in guides so that if the blades are generally horizontal the fingers will be generally vertical and will drop under their own weight due to gravity.

Preferably stop means is provided to prevent the fingers from dropping to the level of the blades so that engagement of blades and fingers is prevented.

When product held by the tool is to be placed, the blades are first retracted to allow the product to drop from the tool or to pass therebetween as the tool is raised, and those fingers which have been elevated by the product fall back into line with the other fingers as the product and tool separate.

Where product can become attached to the fingers and can infiltrate gaps between the latter and guides or sleeves or openings in a plate through which the fingers extend, additional drive means may be provided to positively push all the fingers in a downward manner after product has been released from the tool. This may simply comprise a flat plate or pad

mounted above the fingers which is supported by the upper ends of the fingers and can lift freely as fingers are forced up by product therebelow, and which bears down on the fingers due to its own weight so as to force all the fingers which have been pushed up by product, to drop down into line with the fingers which were not pushed up by product, as the tool and product separate.

Alternatively the plate or pad may be positively driven in a downward sense for example by a pneumatic cylinder or electric motor or solenoid drive.

Alternatively each of the fingers may comprise the piston of a pneumatic cylinder, and air pressure in the cylinders forces all the fingers in a downward sense, but possibly with the aid of a relief valve air is allowed to be released so as to maintain a constant pressure as fingers are pushed upwardly into their cylinders as their lower ends engage product.

The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figs 1A-1D are perspective, top-plan and side elevation views of a gripper tool embodying the first aspect of the invention,

Figs 2A-2D are similar views in which one of the cylinders has been operated to move both blades and support members closer together, as a first step to engaging product (not shown,

Figs 3A-3D are similar views in which both cylinders have been operated so that the blades have moved relative to the support members, to form a platform below product, and

Figs 4A and 4B are side elevation and underside plan views of a multiple pin/finger locating device for use in a gripper such as shown in Figs 1 and 2 and co-pending Application No. 0325068.5 in place of the spikes 82.

In Figs 1-3 the blades are denoted by 204, 206 and the support members by 208, 210. Pneumatic cylinders are denoted by 212, 214.

With both cylinders fully open (extended) the blades and support members will occupy the positions shown in Figs 1A-1D and are fully retracted. The spike assembly 216 is optional.

After lowering the tool onto product (not shown) so as to engage the latter by the spikes of assembly 216 (if fitted) cylinder 212 is closed thereby causing both pairs of blades and support members to move in synchronism inwardly to the position shown in Figs 2A-2D, thereby to engage the product between the support members 208, 210.

Thereafter cylinder 214 is also closed so as to move the blades inwardly relative to the support members to occupy the position shown in Figs 3A-3D.

Rotation of the product can be achieved by rotating the whole tool about the axis 218 (whether spikes are provided or not), and the presence of the support plates 208, 210 guarantees that whether spikes are present or not the product will rotate with the tool.

Delivery of the product onto a support surface is achieved by reversing the procedure after the tool has been lowered so that the product is positioned over the spot on which it is to rest. Thus cylinder 214 is first opened to retract the blades 204, 206 relative to the support members 208, 210 thereafter cylinder 212 is opened to move both blades and support plates clear of the product leaving it on, or to drop onto, the support surface (not shown).

If desired the cylinders 212, 214 may be mounted and operated differently from the manner shown in Figs 1-3, to enable the support plates to move outwardly relative to the blades 204, 206 and remain so displaced so as not to engage the product and permit the tool to operate as described in our co-pending Application.

Where the product is to be surrounded and engaged without penetration, the tool may be modified by removing the spike assembly 218 and fitting in place an assembly of

displaceable pins/fingers as shown in Figs 4A, 4B. This comprises a support plate 220 containing an array of openings having cylindrical sleeves such as 222 which extend coaxially below the openings to serve as guides for a corresponding plurality of cylindrical pins such as 224 which have enlarged heads 226 to prevent their dropping through the openings in the plate 220. The lower ends of the pins are flat and may also be enlarged like the heads 226, to prevent them falling from the plate 220 if the tool is inverted.

Above the upper ends of the pins is located a plate 228 having a flat underside which is movable in a downward direction by extension of a pneumatic cylinder 230. The normal (retracted) position of the plate 228 allows pins such as 224 to move freely in an upward sense if their lower ends engage the upper surface of product such as shown at 232. Those pins which do not engage the product are not displaced and remain in their lower positions. In Fig 4A pin 224 is shown elevated while another pin 234 is one which has not been elevated by product.

The length of the pins is selected so that even in their lower position the lower ends such as 236 of pin 234 will be clear of the blades 238, 240 shown in dotted outline in Fig 4A, so that movement of the blades is not prevented by the pins which have not been pushed up by the product 232.

As best seen in the underside plan view of the plate and pin assembly of Fig 4B pins such as 242, 244, 246 and 248 are very close to the sides of the product. Therefore if the latter tries to move as a result of frictional drag between the product and blades 238, 240 and the latter retract to release the product, it will only move to the extend permitted by pins such as 242, 244, 246 and 248, after which further lateral movement will be restrained y one or more of those pins, as the blades continue to retract.

Any tendency for the product to stick to the pins such as 224 which have been impaled on the upper surface of the product, can be overcome by driving the plate 228 downwardly by extending cylinder 230 as the tool is elevated relative to the product (after the blades 238, 240 have been retracted). This positive displacement of the pins also prevents any from

extending cylinder 230 as the tool is elevated relative to the product (after the blades 238, 240 have been retracted). This positive displacement of the pins also prevents any from sticking in an elevated position for any reason as a result of jamming in their guides 222 or becoming stuck in the latter due to a build up of product.

The drive 230 is optional if the plate 228 is heavy enough, and the latter can be dispensed with if the pins are heavy enough to reliably drop to their lowermost positions when the tool is raised clear of product.

In an alternative arrangement (not shown) closed cylinders may be provided above the openings in plate 220 in which the heads 226 are a sliding fit, and a supply of air under pressure is supplied to each cylinder above each pin head, which will drive the pin downwardly until the head engages the plate 220. If the heads are not an airtight fit, the air will leak around the head to relieve the pressure and reduce the force acting on the pins and/or a pressure relief valve may be employed if the pinheads are a close slipping fit like a piston in a cylinder.

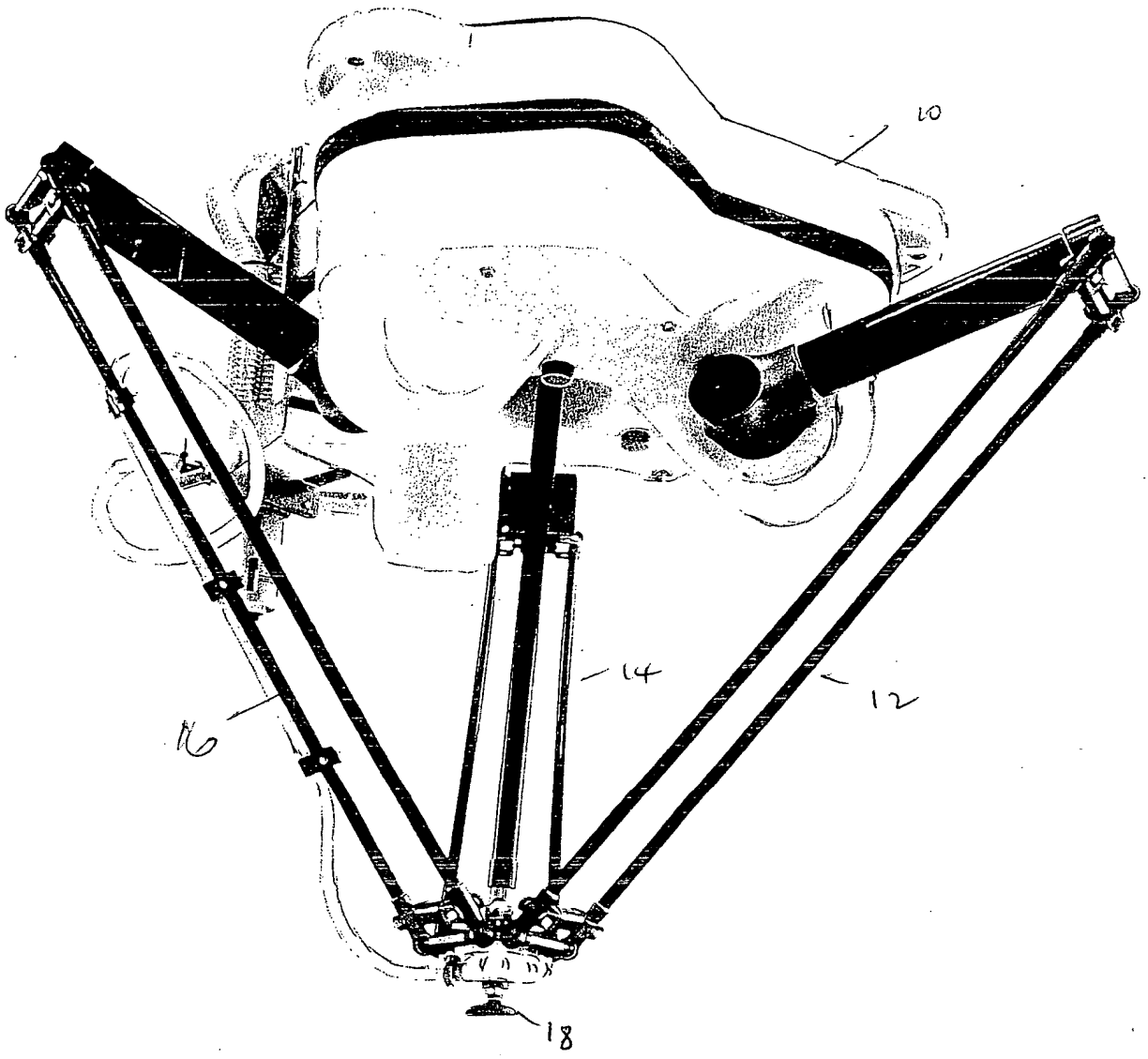


Fig 1

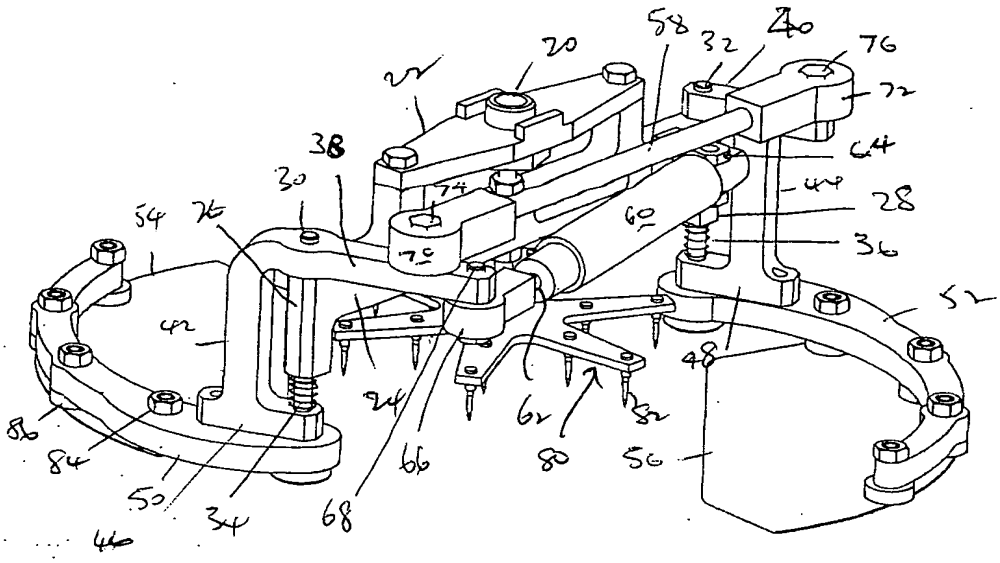


Fig 2

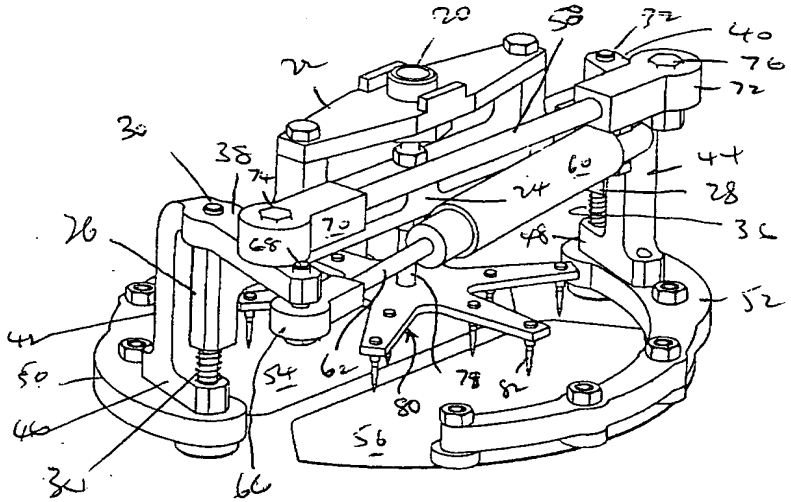


Fig 3

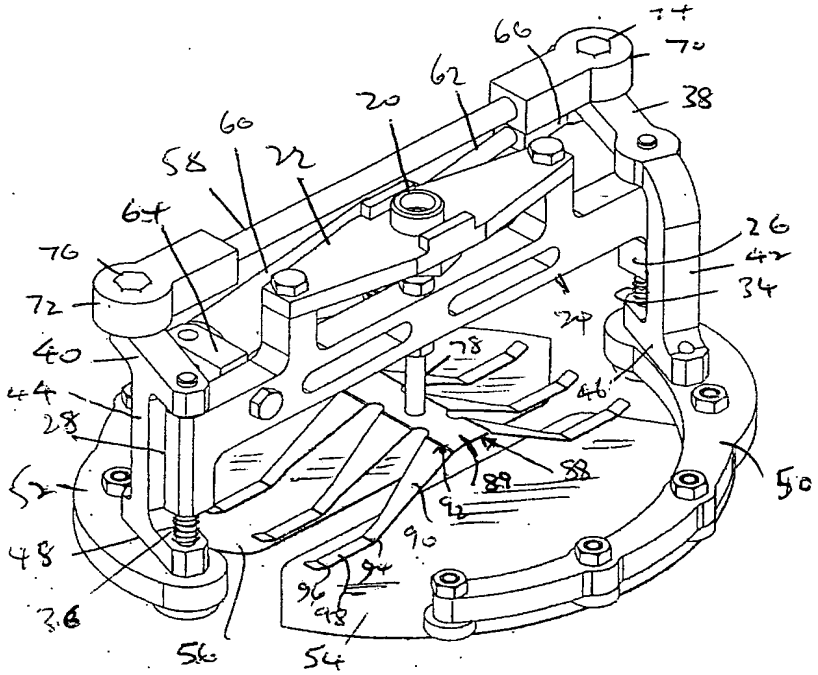


Fig 4

Closed

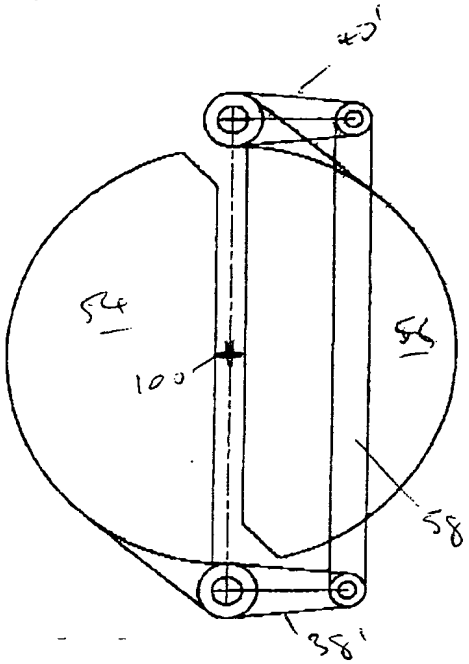


Fig 5A

Open

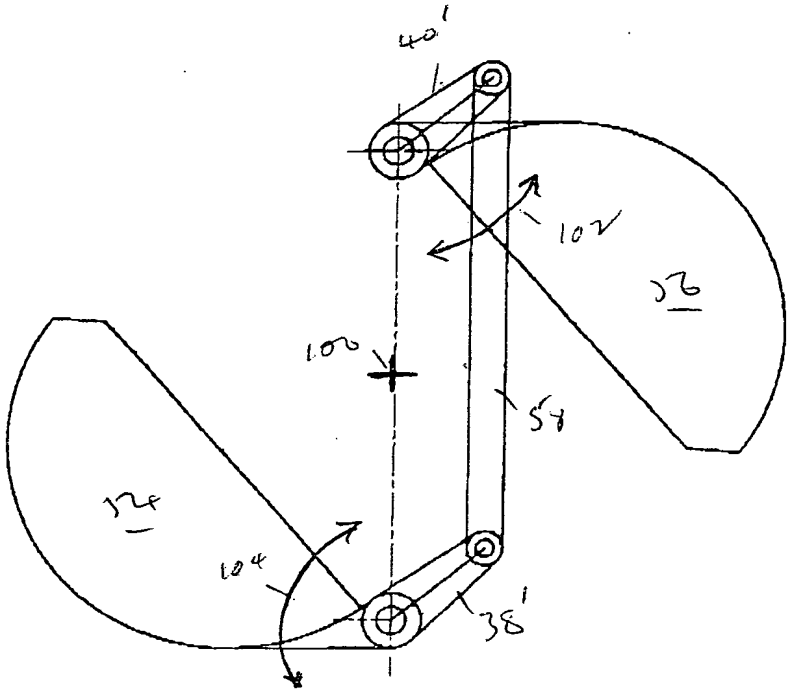


Fig 5B

Closed

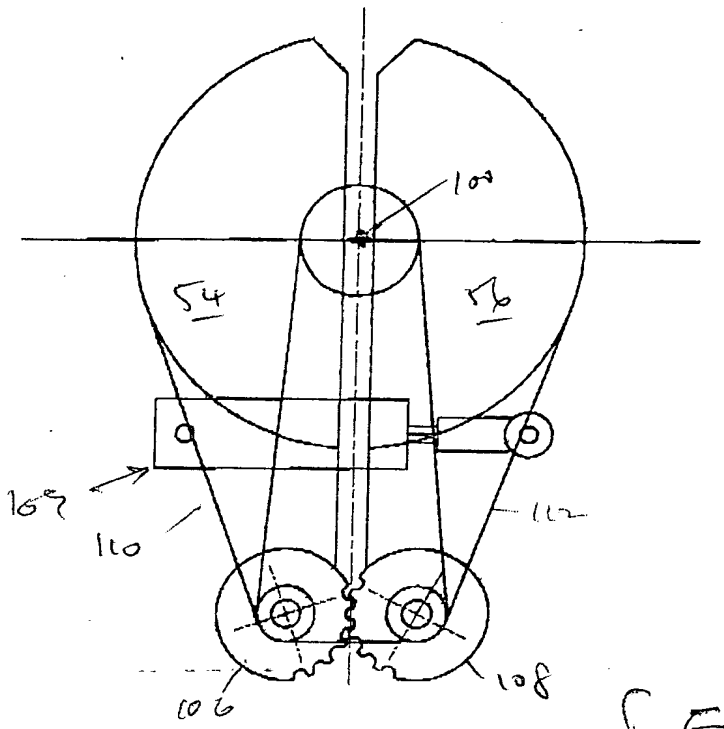


Fig 6A

Open

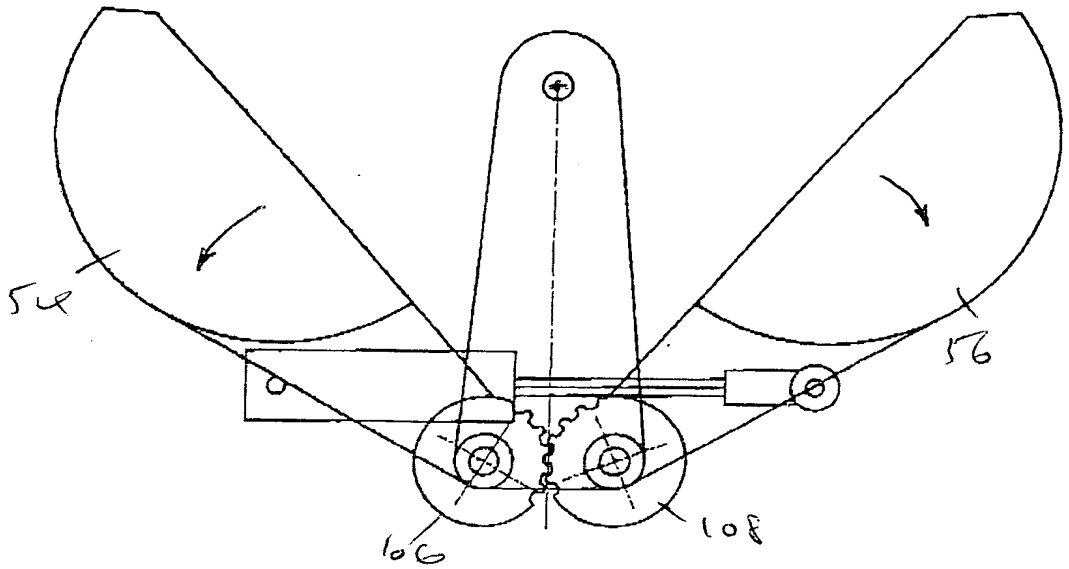


Fig 6B

Closed

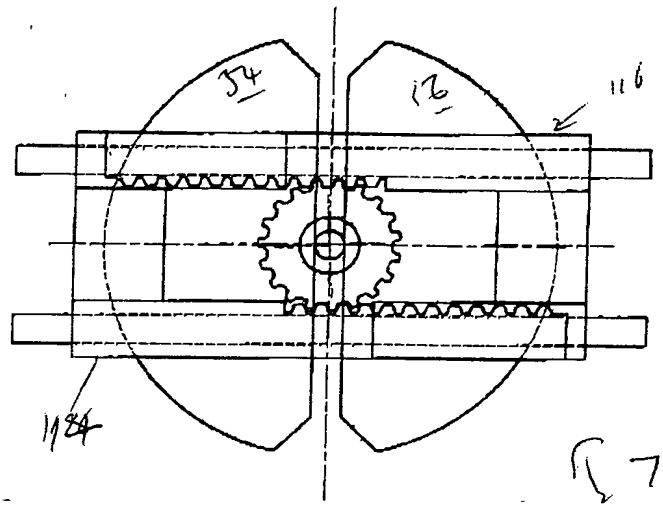


Fig 7A

Open

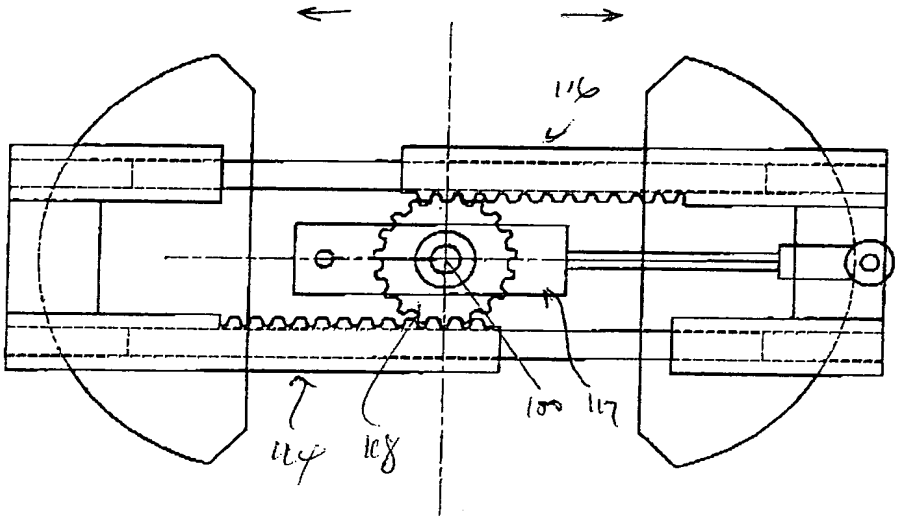


Fig 7B

Closed

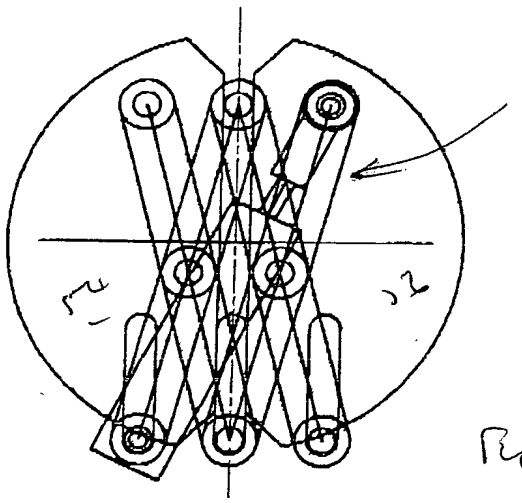


Fig 8A

Open

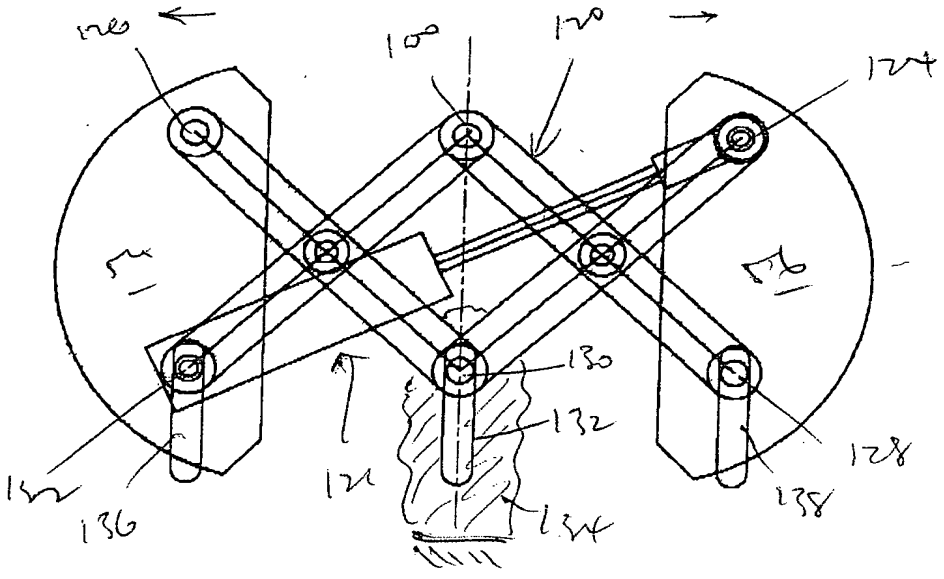


Fig 8B

Closed

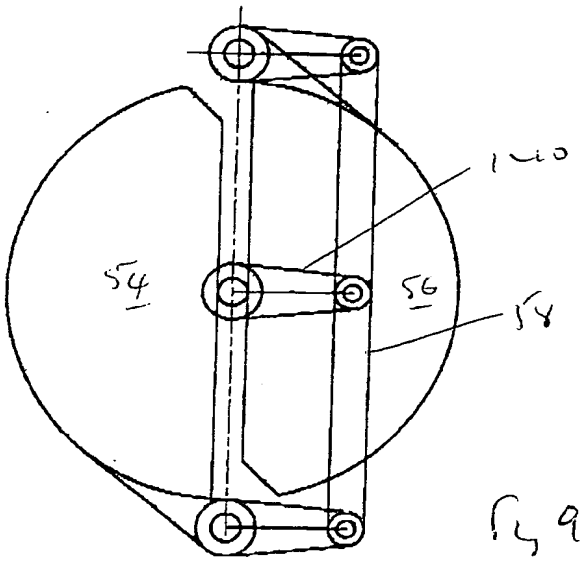


Fig 9A

Open

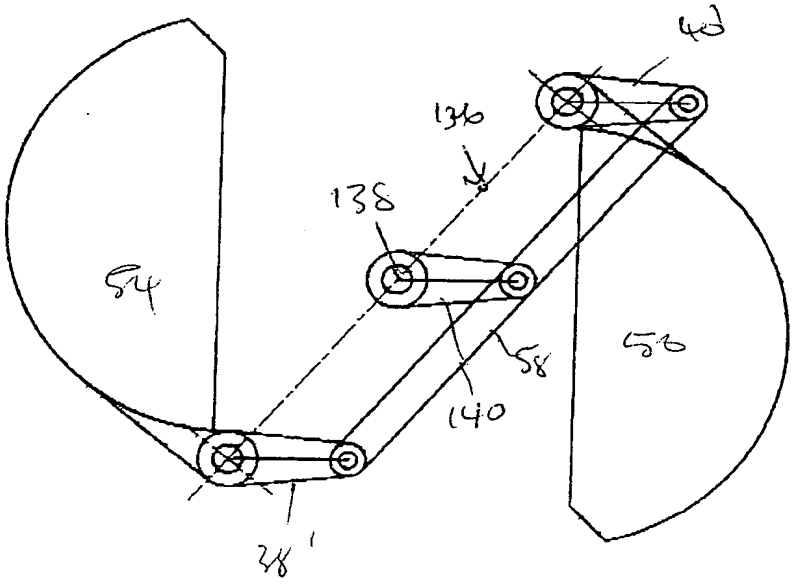


Fig 9B

Closed

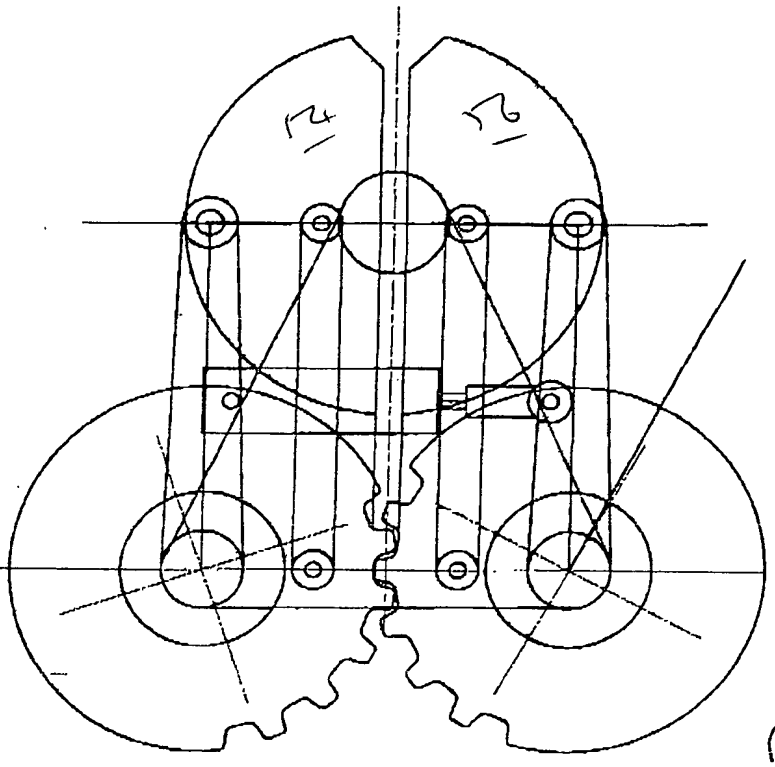


Fig 10A

Open

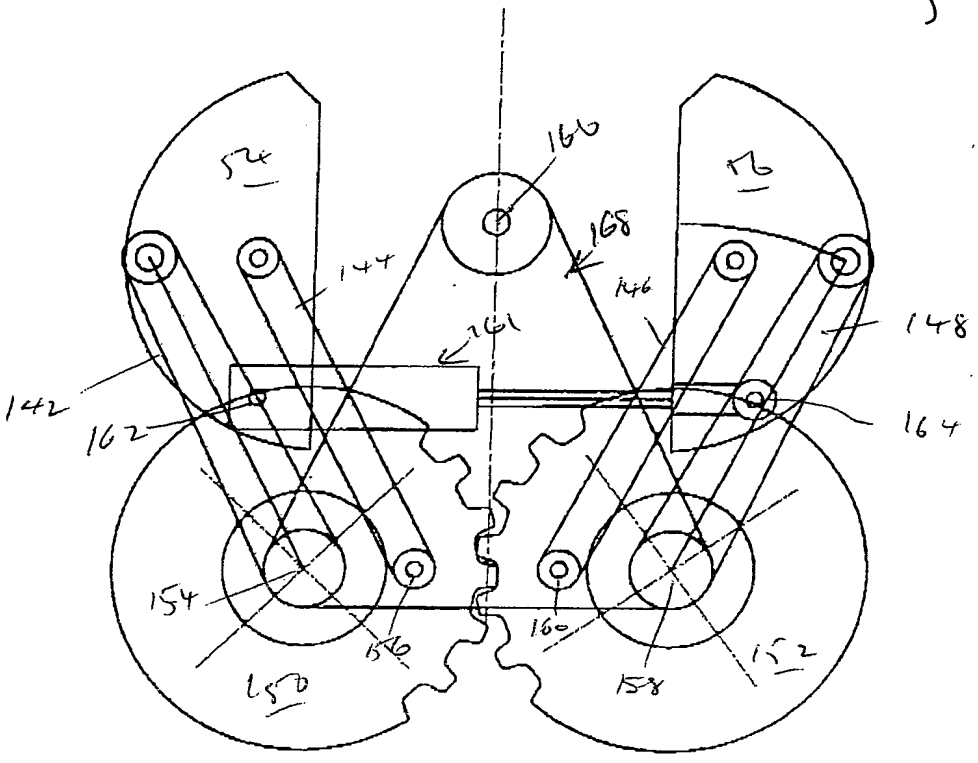


Fig 10B

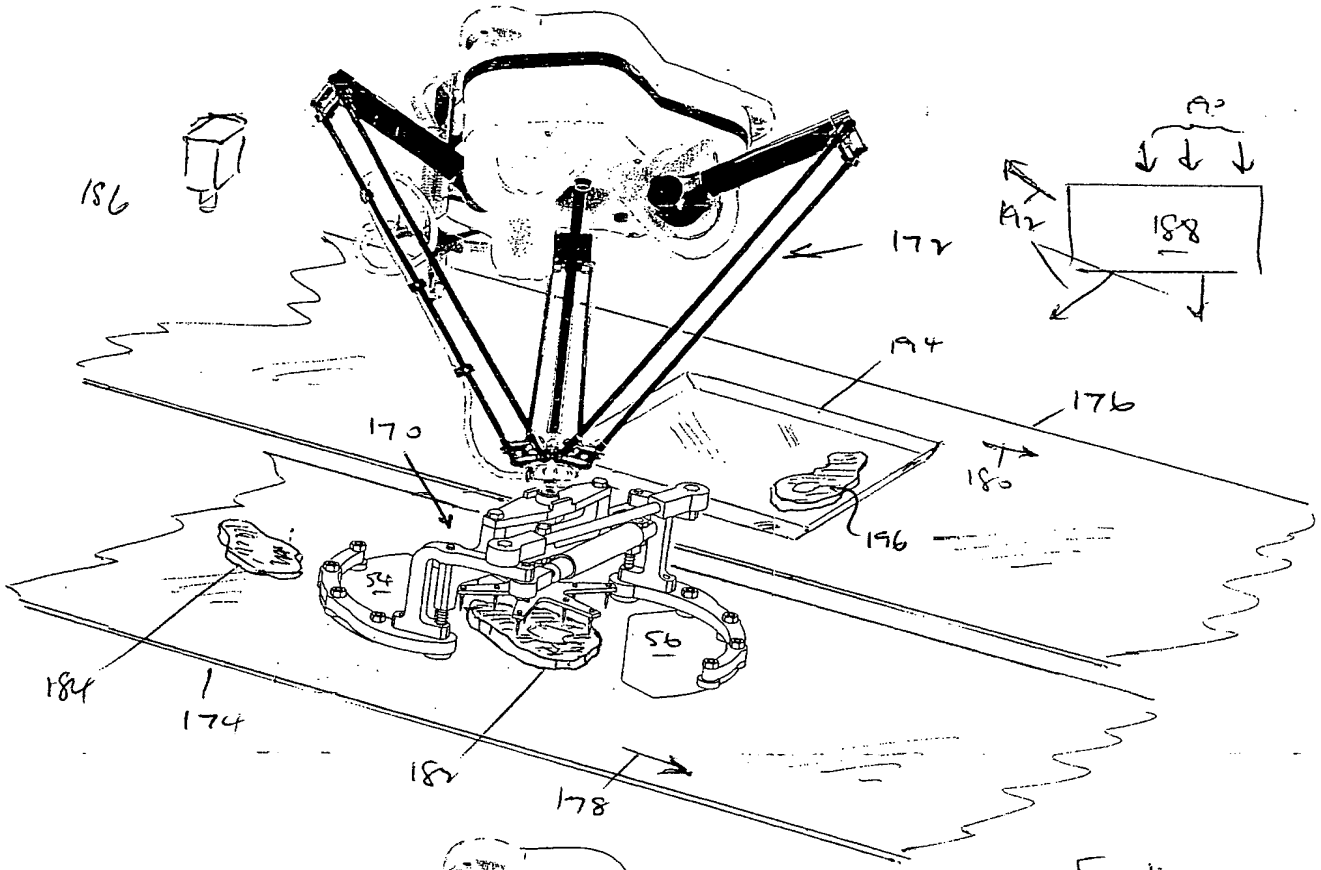

186
172
190
188
192
194
176
180
170
196
54
56
184
174
182
178

Fig 11

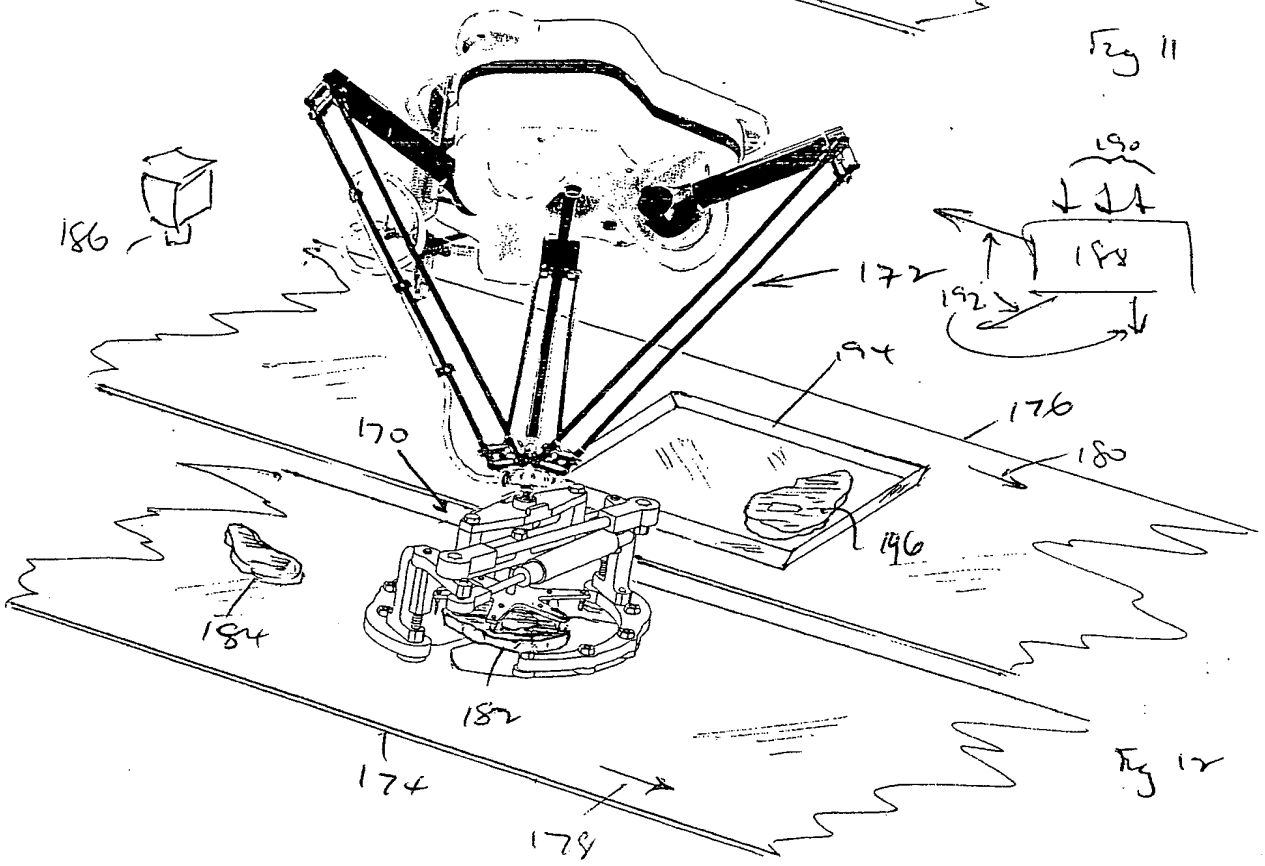

186
172
190
188
192
194
176
180
170
196
184
182
174
178

Fig 12

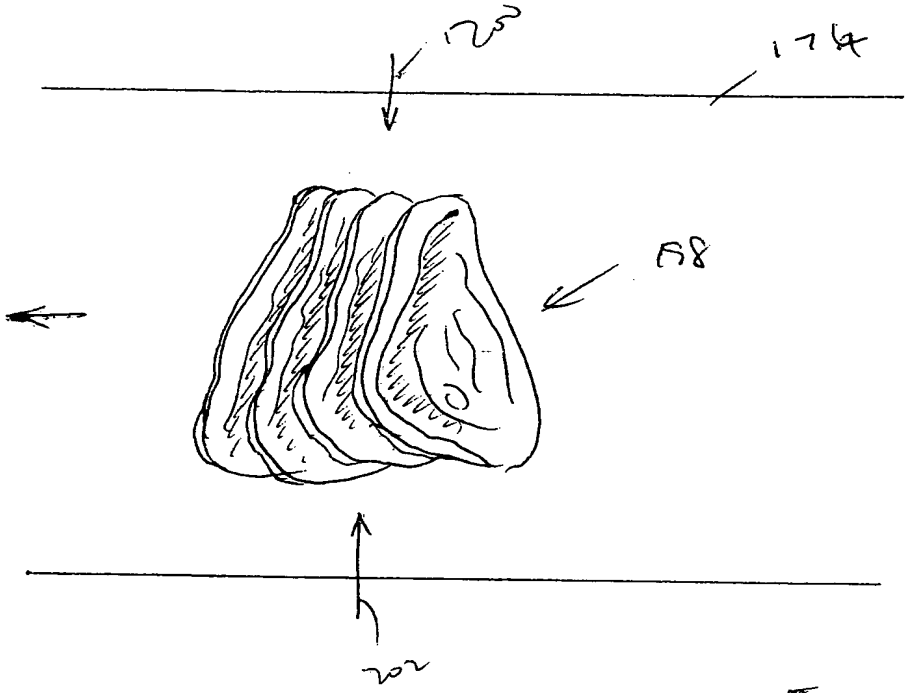


Fig 13